

C11 Relative Strengths of Oxidizing and Reducing Agents

	Oxidizing Agents	Reducing Agents	E° (V)
	$\text{F}_{2(\text{g})} + 2\text{e}^- \rightleftharpoons 2\text{F}_{(\text{aq})}^-$		+2.87
	$\text{PbO}_{2(\text{s})} + \text{SO}_{4(\text{aq})}^{2-} + 4\text{H}_{(\text{aq})}^+ + 2\text{e}^- \rightleftharpoons \text{PbSO}_{4(\text{s})} + 2\text{H}_2\text{O}_{(\text{l})}$		+1.69
	$\text{MnO}_{4(\text{aq})}^- + 8\text{H}_{(\text{aq})}^+ + 5\text{e}^- \rightleftharpoons \text{Mn}_{(\text{aq})}^{2+} + 4\text{H}_2\text{O}_{(\text{l})}$		+1.51
	$\text{Au}_{(\text{aq})}^{3+} + 3\text{e}^- \rightleftharpoons \text{Au}_{(\text{s})}$		+1.50
	$\text{ClO}_{4(\text{aq})}^- + 8\text{H}_{(\text{aq})}^+ + 8\text{e}^- \rightleftharpoons \text{Cl}_{(\text{aq})}^- + 4\text{H}_2\text{O}_{(\text{l})}$		+1.39
	$\text{Cl}_{2(\text{g})} + 2\text{e}^- \rightleftharpoons 2\text{Cl}_{(\text{aq})}^-$		+1.36
	$2\text{HNO}_{2(\text{aq})} + 4\text{H}_{(\text{aq})}^+ + 4\text{e}^- \rightleftharpoons \text{N}_{2\text{O}_{(\text{g})}} + 3\text{H}_2\text{O}_{(\text{l})}$		+1.30
	$\text{Cr}_2\text{O}_{7(\text{aq})}^{2-} + 14\text{H}_{(\text{aq})}^+ + 6\text{e}^- \rightleftharpoons 2\text{Cr}_{(\text{aq})}^{3+} + 7\text{H}_2\text{O}_{(\text{l})}$		+1.23
	$\text{O}_{2(\text{g})} + 4\text{H}_{(\text{aq})}^+ + 4\text{e}^- \rightleftharpoons 2\text{H}_2\text{O}_{(\text{l})}$		+1.23
	$\text{MnO}_{2(\text{s})} + 4\text{H}_{(\text{aq})}^+ + 2\text{e}^- \rightleftharpoons \text{Mn}_{(\text{aq})}^{2+} + 2\text{H}_2\text{O}_{(\text{l})}$		+1.22
	$2\text{IO}_{3(\text{aq})}^- + 12\text{H}_{(\text{aq})}^+ + 10\text{e}^- \rightleftharpoons \text{I}_{2(\text{s})} + 6\text{H}_2\text{O}_{(\text{l})}$		+1.20
	$\text{Br}_{2(\text{l})} + 2\text{e}^- \rightleftharpoons 2\text{Br}_{(\text{aq})}^-$		+1.07
	$\text{Hg}_{(\text{aq})}^{2+} + 2\text{e}^- \rightleftharpoons \text{Hg}_{(\text{l})}$		+0.85
	$\text{ClO}_{(\text{aq})}^- + \text{H}_2\text{O}_{(\text{l})} + 2\text{e}^- \rightleftharpoons \text{Cl}_{(\text{aq})}^- + 2\text{OH}_{(\text{aq})}^-$		+0.84
	$\text{Ag}_{(\text{aq})}^+ + \text{e}^- \rightleftharpoons \text{Ag}_{(\text{s})}$		+0.80
	$\text{NO}_{3(\text{aq})}^- + 2\text{H}_{(\text{aq})}^+ + \text{e}^- \rightleftharpoons \text{NO}_{2(\text{g})} + \text{H}_2\text{O}_{(\text{l})}$		+0.80
	$\text{Fe}_{(\text{aq})}^{3+} + \text{e}^- \rightleftharpoons \text{Fe}_{(\text{aq})}^{2+}$		+0.77
	$\text{O}_{2(\text{g})} + 2\text{H}_{(\text{aq})}^+ + 2\text{e}^- \rightleftharpoons \text{H}_2\text{O}_{2(\text{l})}$		+0.70
	$\text{MnO}_{4(\text{aq})}^- + 2\text{H}_2\text{O}_{(\text{l})} + 3\text{e}^- \rightleftharpoons \text{MnO}_{2(\text{s})} + 4\text{OH}_{(\text{aq})}^-$		+0.60
	$\text{I}_{2(\text{s})} + 2\text{e}^- \rightleftharpoons 2\text{I}_{(\text{aq})}^-$		+0.54
	$\text{Cu}_{(\text{aq})}^+ + \text{e}^- \rightleftharpoons \text{Cu}_{(\text{s})}$		+0.52
	$\text{O}_{2(\text{g})} + 2\text{H}_2\text{O}_{(\text{l})} + 4\text{e}^- \rightleftharpoons 4\text{OH}_{(\text{aq})}^-$		+0.40
	$\text{Cu}_{(\text{aq})}^{2+} + 2\text{e}^- \rightleftharpoons \text{Cu}_{(\text{s})}$		+0.34
	$\text{SO}_{4(\text{aq})}^{2-} + 4\text{H}_{(\text{aq})}^+ + 2\text{e}^- \rightleftharpoons \text{H}_2\text{SO}_{3(\text{aq})} + \text{H}_2\text{O}_{(\text{l})}$		+0.17
	$\text{Sn}_{(\text{aq})}^{4+} + 2\text{e}^- \rightleftharpoons \text{Sn}_{(\text{aq})}^{2+}$		+0.15
	$\text{Cu}_{(\text{aq})}^{2+} + \text{e}^- \rightleftharpoons \text{Cu}_{(\text{aq})}^+$		+0.15
	$\text{S}_{(\text{s})} + 2\text{H}_{(\text{aq})}^+ + 2\text{e}^- \rightleftharpoons \text{H}_2\text{S}_{(\text{aq})}$		+0.14
	$\text{AgBr}_{(\text{s})} + \text{e}^- \rightleftharpoons \text{Ag}_{(\text{s})} + \text{Br}_{(\text{aq})}^-$		+0.07
	$2\text{H}_{(\text{aq})}^+ + 2\text{e}^- \rightleftharpoons \text{H}_{2(\text{g})}$		0.00
	$\text{Pb}_{(\text{aq})}^{2+} + 2\text{e}^- \rightleftharpoons \text{Pb}_{(\text{s})}$		-0.13
	$\text{Sn}_{(\text{aq})}^{2+} + 2\text{e}^- \rightleftharpoons \text{Sn}_{(\text{s})}$		-0.14
	$\text{AgI}_{(\text{s})} + \text{e}^- \rightleftharpoons \text{Ag}_{(\text{s})} + \text{I}_{(\text{aq})}^-$		-0.15
	$\text{Ni}_{(\text{aq})}^{2+} + 2\text{e}^- \rightleftharpoons \text{Ni}_{(\text{s})}$		-0.26
	$\text{Co}_{(\text{aq})}^{2+} + 2\text{e}^- \rightleftharpoons \text{Co}_{(\text{s})}$		-0.28
	$\text{H}_3\text{PO}_{4(\text{aq})} + 2\text{H}_{(\text{aq})}^+ + 2\text{e}^- \rightleftharpoons \text{H}_3\text{PO}_{3(\text{aq})} + \text{H}_2\text{O}_{(\text{l})}$		-0.28
	$\text{PbSO}_{4(\text{s})} + 2\text{e}^- \rightleftharpoons \text{Pb}_{(\text{s})} + \text{SO}_{4(\text{aq})}^{2-}$		-0.36
	$\text{Se}_{(\text{s})} + 2\text{H}_{(\text{aq})}^+ + 2\text{e}^- \rightleftharpoons \text{H}_2\text{Se}_{(\text{aq})}$		-0.40
	$\text{Cd}_{(\text{aq})}^{2+} + 2\text{e}^- \rightleftharpoons \text{Cd}_{(\text{s})}$		-0.40
	$\text{Cr}_{(\text{aq})}^{3+} + \text{e}^- \rightleftharpoons \text{Cr}_{(\text{aq})}^{2+}$		-0.41
	$\text{Fe}_{(\text{aq})}^{2+} + 2\text{e}^- \rightleftharpoons \text{Fe}_{(\text{s})}$		-0.44
	$\text{Ag}_2\text{S}_{(\text{s})} + 2\text{e}^- \rightleftharpoons 2\text{Ag}_{(\text{s})} + \text{S}_{(\text{aq})}^{2-}$		-0.69
	$\text{Zn}_{(\text{aq})}^{2+} + 2\text{e}^- \rightleftharpoons \text{Zn}_{(\text{s})}$		-0.76
	$\text{Te}_{(\text{s})} + 2\text{H}_{(\text{aq})}^+ + 2\text{e}^- \rightleftharpoons \text{H}_2\text{Te}_{(\text{aq})}$		-0.79
	$2\text{H}_2\text{O}_{(\text{l})} + 2\text{e}^- \rightleftharpoons \text{H}_{2(\text{g})} + 2\text{OH}_{(\text{aq})}^-$		-0.83
	$\text{Cr}_{(\text{aq})}^{2+} + 2\text{e}^- \rightleftharpoons \text{Cr}_{(\text{s})}$		-0.91
	$\text{SO}_{4(\text{aq})}^{2-} + \text{H}_2\text{O}_{(\text{l})} + 2\text{e}^- \rightleftharpoons \text{SO}_{3(\text{aq})}^{2-} + 2\text{OH}_{(\text{aq})}^-$		-0.93
	$\text{Al}_{(\text{aq})}^{3+} + 3\text{e}^- \rightleftharpoons \text{Al}_{(\text{s})}$		-1.66
	$\text{Mg}_{(\text{aq})}^{2+} + 2\text{e}^- \rightleftharpoons \text{Mg}_{(\text{s})}$		-2.37
	$\text{Na}_{(\text{aq})}^+ + \text{e}^- \rightleftharpoons \text{Na}_{(\text{s})}$		-2.71
	$\text{Ca}_{(\text{aq})}^{2+} + 2\text{e}^- \rightleftharpoons \text{Ca}_{(\text{s})}$		-2.87
	$\text{Ba}_{(\text{aq})}^{2+} + 2\text{e}^- \rightleftharpoons \text{Ba}_{(\text{s})}$		-2.91
	$\text{K}_{(\text{aq})}^+ + \text{e}^- \rightleftharpoons \text{K}_{(\text{s})}$		-2.93
	$\text{Li}_{(\text{aq})}^+ + \text{e}^- \rightleftharpoons \text{Li}_{(\text{s})}$		-3.04

SOA
Strongest
Oxidizing
Agent

Decreasing Strength of Oxidizing Agents

Decreasing Strength of Reducing Agents

SRA
Strongest
Reducing
Agent

- All E° values are reduction potentials measured relative to the standard hydrogen electrode. E° values are measured using standard half-cells with both the oxidizing and reducing agents present at SATP using 1.0 mol/L solutions.
- Values in this table are taken from *The CRC Handbook of Chemistry and Physics*, 71st Edition.